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ARTICLES

THE IMPACT OF INTERGOVERNMENTAL DISTANCE ON DISASTER COMMUNICATIONS*

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Previous research into disaster communications, while fairly extensive, has been limited primarily to sociological analysis and organizational theory. This body of research, however, has not explored disaster communications in a federal, international or other multi-level governmental response system. This paper expands upon existing research to present a new theory of intergovernmental disaster communications.

The theory is based on the concept of intergovernmental distance, which refers to distance in terms of differing procedures and approaches used by organizations in different functional areas at various levels of government. The theory postulates that the organizational distance created by these differences becomes a critical factor that must be addressed during a disaster.

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The study employs three sets of dimensions. The first is in two dimensions and examines distances between functional areas at various levels of government. The second is three dimensional and considers distances between functional area and central management. The third is multidimensional. Here a multiple regression equation is used to analyze intergovernmental distance.

The study concludes by addressing the policy implications of the findings, especially the need to overcome inherent intergovernmental distance through disaster planning, the need to recognize the exponential increase in communications problems caused by increases in the number of disaster responders, and the need to determine if the marginal benefits contributed by each new responder exceed the marginal communications and coordination costs each responder imposes.

Previous research into disaster communications, while fairly extensive, has been limited primarily to sociological analysis and organizational theory. Research of note includes that of Drabek (1981), Dynes and Quarantelli (1977), and Stallings (1971). Other relevant research includes insights into American federalism offered by Sanford (1967). This body of research, discussed below, has not explored disaster communications in a federal, international or other multi-level governmental response system. This paper builds from existing research by proposing a new theory of intergovernmental disaster communications. The proposed theory is presented in three sections: theoretical background, the theory of intergovernmental distance, and policy implications of the theory.

Theoretical Background

Stallings theorized that organization-sets play a key role in interorganizational disaster communications. Organizations within a particular set have pre-established relationships resulting from their inherent interdependencies. Stalling proposed a theorem that "problems of interorganizational communication in a disaster appear to be **inversely**

related to the extent of previous communication experience. Put another way, communications problems in a disaster are more likely to arise in contacts with organizations **outside** the normal organization-set than those inside the set itself" (emphasis in the original).

Dynes and Quarantelli reviewed four detailed disaster case studies and the disaster literature, and derived 294 propositions on disaster communications. The following are most relevant to the intergovernmental aspects of disaster communications:

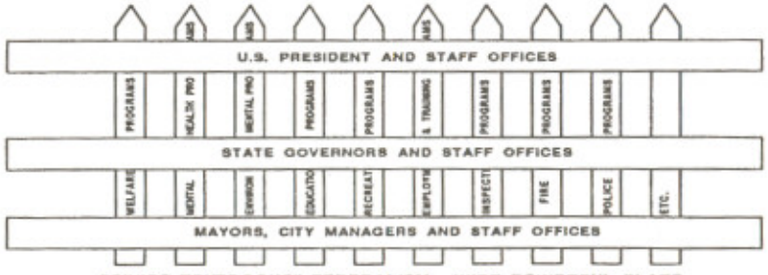
- Under conditions of stress, communication overload is precipitated by both an increase in internal organizational communication and extraorganizational input. (Proposition 195)
- Under conditions of stress, sociological, not technological, factors are responsible for impaired organizational communications. (Proposition 203)
- Under conditions of stress ... some organizations increase greatly in size. (Proposition 236)
- Increased organizational size increases the potential channels of communication. (Proposition 237)
- Due to increased organizational size and potential channels of communication, appropriate communication channels are seldom worked out. (Proposition 238)
- Due to the fact that appropriate communication channels are seldom worked out, persons in crucial parts of the organization are flooded with irrelevant information. (Proposition 239)

Drabek and his associates mapped actual communications between responding organizations in the first seven hours after various disasters. They found that between 10 and 80 federal, state, local, and voluntary organizations responded to even minor disasters. The number of communications channels used far exceeded the number of agencies responding because almost every agency was communicating with every other agency involved. This greatly complicated coordination efforts. For example, while communications existed between almost all responding agencies, there

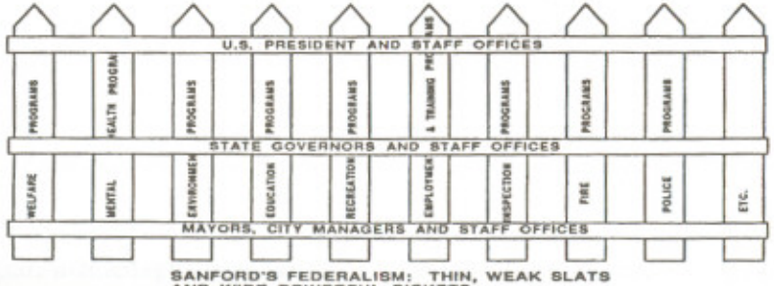
dination procedures. The implication of Drabek's work is that problems with interagency and intergovernmental communications significantly impaired the response effort in all instances except when the disaster was extremely small or the responding units had undertaken extensive pre-disaster planning.

While not specifically disaster related, Sanford's theory of "picket fence federalism" (see Exhibit 1) is also particularly relevant here. Stanford noted that in traditional American federalist and "civics textbook" thought, power should rest with the central management officials at each level of government (e.g., the President, Governor, mayor, county or city manager). Department heads in various functional areas are expected to look to these officials for direction. For example, the director of state-level department of agriculture would be expected to look to the state Governor for guidance and leadership. This is shown in the upper part of the exhibit by the wide (powerful) "slats" and the narrow (weak) "pickets" in the fence.

EXHIBIT 1
PICKET FENCE FEDERALISM



"CIVICS TEXTBOOKS" FEDERALISM: WIDE POWERFUL SLATS AND THIN, WEAK PICKETS.



SANFORD'S FEDERALISM: THIN, WEAK SLATS AND WIDE POWERFUL PICKETS.

Stanford observed that in practice the links **within** functional areas were stronger than the line to central management links. In part this was due to the fact that funds tend to flow down functional "pickets" from the federal to the state to the local levels. Hence, the director of a state-level department of agriculture actually tends to look for technical and policy guidance and leadership from (federal) U.S. Department of Agriculture officials rather than from the Governor. This is shown in the lower part of the exhibit by the weak slats and strong pickets.

Building from Sanford's reasoning, it is possible to extend the theory of disaster communications into the realms of public administration and federalism through the theory of "intergovernmental distance."

The Theory of Intergovernmental Distance

The theory of intergovernmental distance will be discussed in five sections. First, we will define the concept. Second, we will present a two dimensional approach which examines only the distance between functional areas and levels of government. Third, we will present a three dimensional view, which adds a central core of government as another level of complexity. Fourth, we will discuss a multi-factor, regression approach to analyzing intergovernmental distance. Finally, we will discuss assumptions underlying the theory.

Definition

The concept of intergovernmental distance does not refer to spatial distance. Rather it refers to distance in terms of differing procedures and approaches used by agencies and organizations at various levels of government in undertaking their normal and emergency tasks. For example, different organizations may vary in their communications equipment and procedures, and in their goals, training, background, jargon, organizational culture, forms, budgets, reimbursement procedures, job descriptions, etc.

The organizational distance created by these differences become a critical factor which must be addressed during a disaster. For example, problems can arise if responding agencies have not reached common understanding on their roles - the nature of the disaster itself and the most

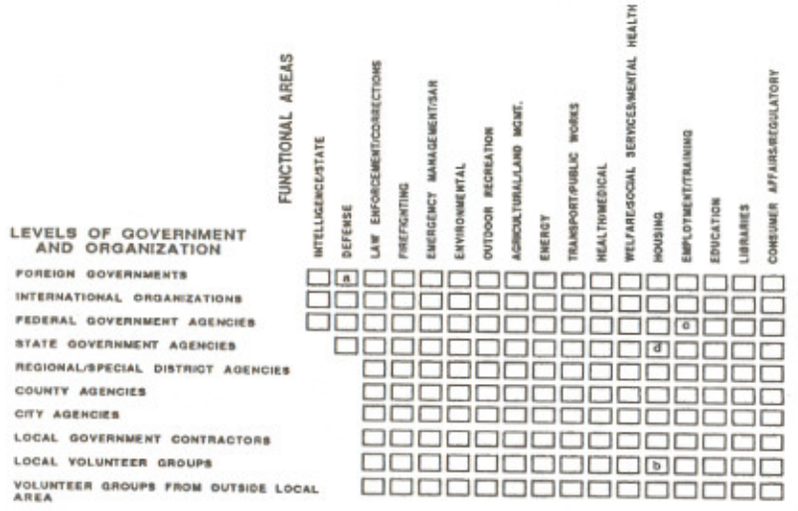
critical response needs - the chain of command, if any - approaches to using emergent groups - flexibility in interpreting rules - acceptance of, or rivalry with, other responding groups - and perceptions or knowledge of local physical, economic, political, and cultural conditions. In the case of responses by international or foreign organizations the responders and the locals may literally be speaking a different language.

A Two Dimensional Approach

The two-dimensional version of the theory is present in Exhibit 2. Here we see that on the x-axis the various functional areas from Sanford have been arranged so that areas with similar missions are adjacent to each other, and have been expanded to include other levels of government and organization that might respond to an emergency, including voluntary groups and agencies, international and foreign government agencies, regional agencies and contractors. (Here the term "voluntary groups and agencies" includes "emergent," "expanding" and "extending" groups that are formed during a disaster; see Dynes and Quarantelli, 1977 and Quarantelli, 1985.) Within the matrix, each cell represents an organization at that level of government and within that functional area. Certain cells are missing, because levels of government and organization below the state level do not generally have military and intelligence agencies.

The theory of intergovernmental distance posits that organizations that are close together on the chart are more likely to have had communications and interactions **before** a disaster, and thus, using Stallings theorem, are more likely to have fewer communications problems **during** and immediately following a disaster. We theorize the converse as well. For example, imagine a hypothetical disaster in which only two organizations responded. Assume these two to be a unit of a foreign government defense agency ("a" in the exhibit). It is likely that these groups would have communicated before the disaster, barring some unusual efforts at pre-planning or some other unusual factor linking the two organizations. Thus, they would probably have substantial communication and coordination difficulties during a disaster. In our terms, the intergovernmental distance is high.

EXHIBIT 2
TWO DIMENSIONAL INTERGOVERNMENTAL DISTANCE SCALE



The theory also postulates that it may be possible (given some major assumptions) to measure the distance between these two (or any) organizations in terms of "intergovernmental distance units" (IDs). This measure of distance can serve as a rough device for estimating the difficulty the groups will have in communicating effectively during a disaster.

To permit calculation of intergovernmental distance, we make the following major assumption relative to Figure 2: the x and y axes represent interval scales defining a plane, both measured in identical units of IDs, with each box equal to one ID unit. In this plane we assume that the intergovernmental distance is the shortest distance between two points on the plane. We also assume and hold constant all the factors that affect the true intergovernmental distance in reality--factors such as the degree of previous interagency coordination, similarity of missions, scope and organizational structures, existing financial relationships, and previous professional relationships. In addition, each box is treated as a single organization, when in fact it may be comprised of several entities (e.g., there are many organizations which comprise the

Federal state/intelligence agency box). (Some of these rigid, major assumptions will be relaxed in later discussion.)

As a simple example of the calculations possible under the assumptions listed, again consider the two organizations "a" and "b." Here we see that organization "a" is 8 IDs distant on the y-axis and 11 IDs distant on the x-axis from organization "b." We use the Pythagorean theorem to calculate the distance between these two points to be about 13.6 IDs.

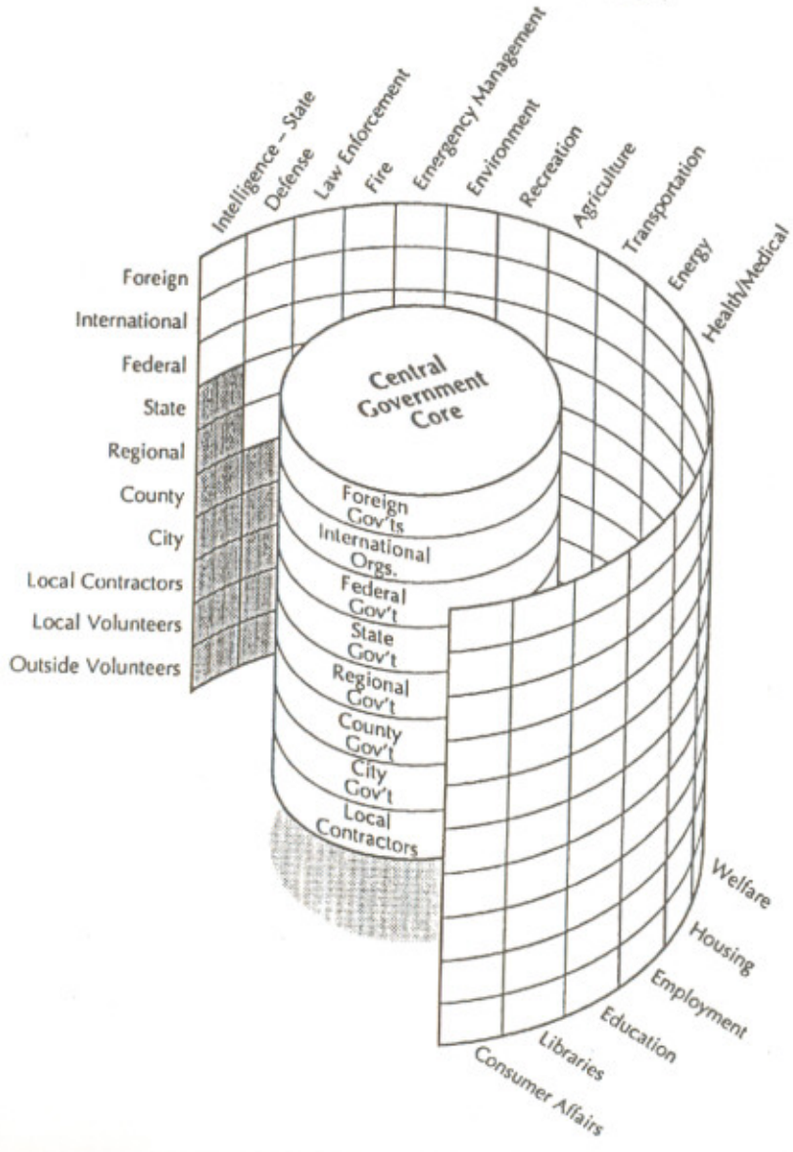
As a separate example, let us examine organizations "c" and "d", which are intuitively closer in reality, and correspondingly closer together on the chart. Using the same calculation method results in a distance of 1.4, significantly smaller than the distance between "a" and "b." It can, therefore, be estimated that a hypothetical disaster in which only "c" and "d" respond will have fewer communications difficulties than a hypothetical disaster in which only "a" and "b" respond.

These examples and this version of the theory lack Sanford's insight into the "slats" -- the relationship between central government offices and functional area organizations. Adding this concept adds a third dimension to the theory of intergovernmental distance.

A Three Dimensional Approach

The three-dimensional version of the theory is presented in Exhibit 3. Here we see that the simple plane of levels and functions in Exhibit 2 has been wrapped around a core of central government agencies. Examples of these include the President, a Governor, a county manager or a city mayor. Certain levels have no such core, because it is assumed that no appropriate cells exist. (One is hard pressed to imagine a local volunteer group active in the central government management area responding to a disaster. On the other hand, one could imagine a contractor, such as a management consultant to the local city manager's office, responding to an emergency.) Each level of the core is assumed to be equivalent of one box on the plane--i.e., it is not subdivided into parts. Each level of the core is assumed to be equidistant from each of the functional agencies at that level of government--i.e., the Executive Office of the President is the same intergovernmental distance from the state/intelligence box as it is from the energy or the housing box. (It is this necessary assumption of equidistance which means that a curved plane, not a cube, is the required three-dimensional model.)

Exhibit 3
A Three Dimensional Version of the Theory



The thrust of this version of the theory is the same as in the earlier version. Disaster response by agencies which are far apart in the model is likely to lead to communications difficulties. Response by agencies close together in the model is likely to result in fewer communications and coordination difficulties. This is particularly so for agencies immediately adjacent within levels, for those immediately adjacent within functional areas, and for those closely aligned within levels between functional and central government agencies.

As in the two-dimensional model, calculations of the intergovernmental distance are possible, given certain major assumptions. These include all the assumptions discussed for the two dimensional model and the assumption of equidistance, presented above. We also assume that the distance within one level from the core to the plane is **two** units (not one), following Sanford's observation that line organizations are closer to their counterparts at the next level than they are to the central governing organizations. For ease of calculation and to avoid the complexities of spherical mathematics, we assume that lines that are in the curved plane (and thus don't involve the central core) can be measured as though they are in a flat plane.

With these assumptions made, we can make some simple illustrative calculations, as shown in Exhibits 4 and 5.

Exhibit 4 shows a hypothetical disaster in which three organizations from the same level of government/organization respond. Here organization "c" is 2 IDs from "a" and 2 IDs from "b." Organizations "a" and "b" are 6 units apart (recall that for this particular measurement we assume the plane is flat). Thus, the total intergovernmental distance involved is 10.

Exhibit 5 shows a response by three organizations from different levels of government/organization. Here the distance from "a" to "b" is the square root of 17, or about 4.1. The distance from "c" to "a" is calculated by going up two levels (2 IDs), going from the core to the plane (2 IDs), and calculating the hypotenuse of the resulting right triangle. The distance is, thus, the square root of 8, or about 2.8. The distance from "b" to "c" is similarly calculated. The sum of the three distances is about 9.7.

Exhibit 4
Hypothetical Disaster with Three Responses from One Level

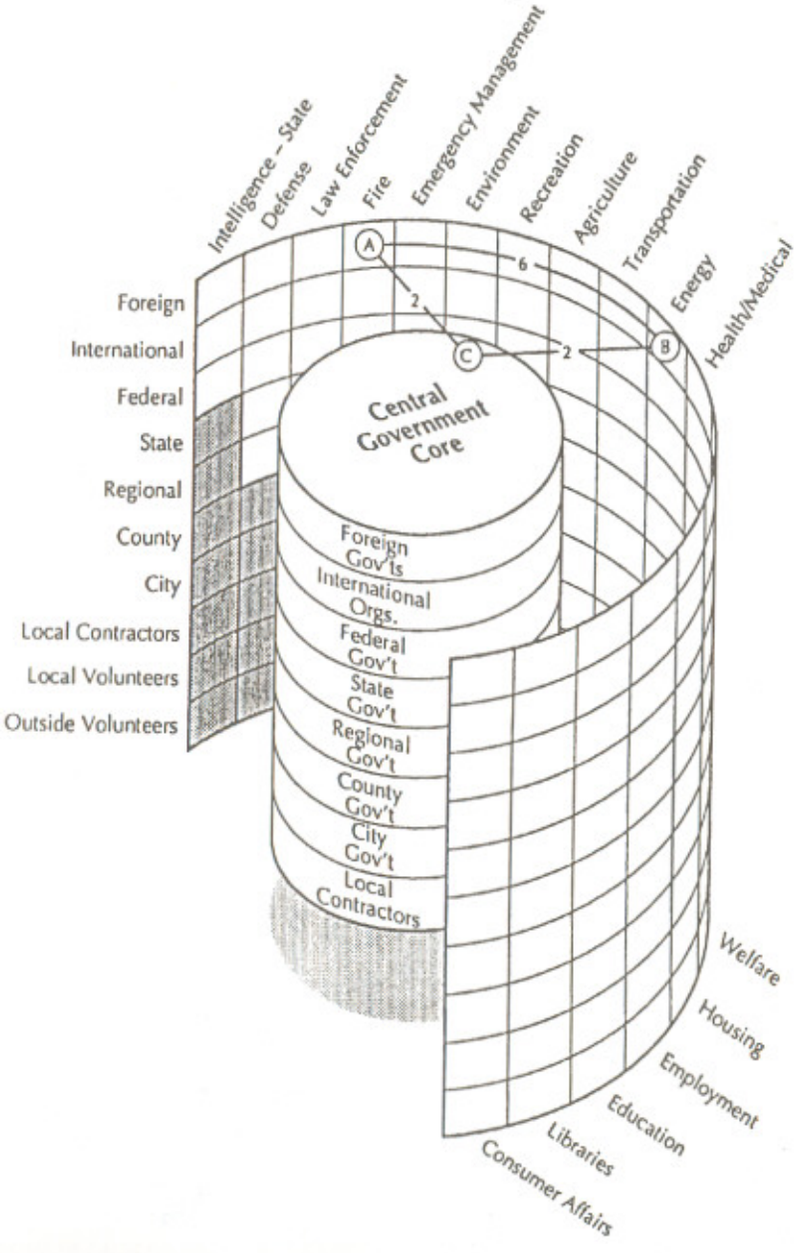
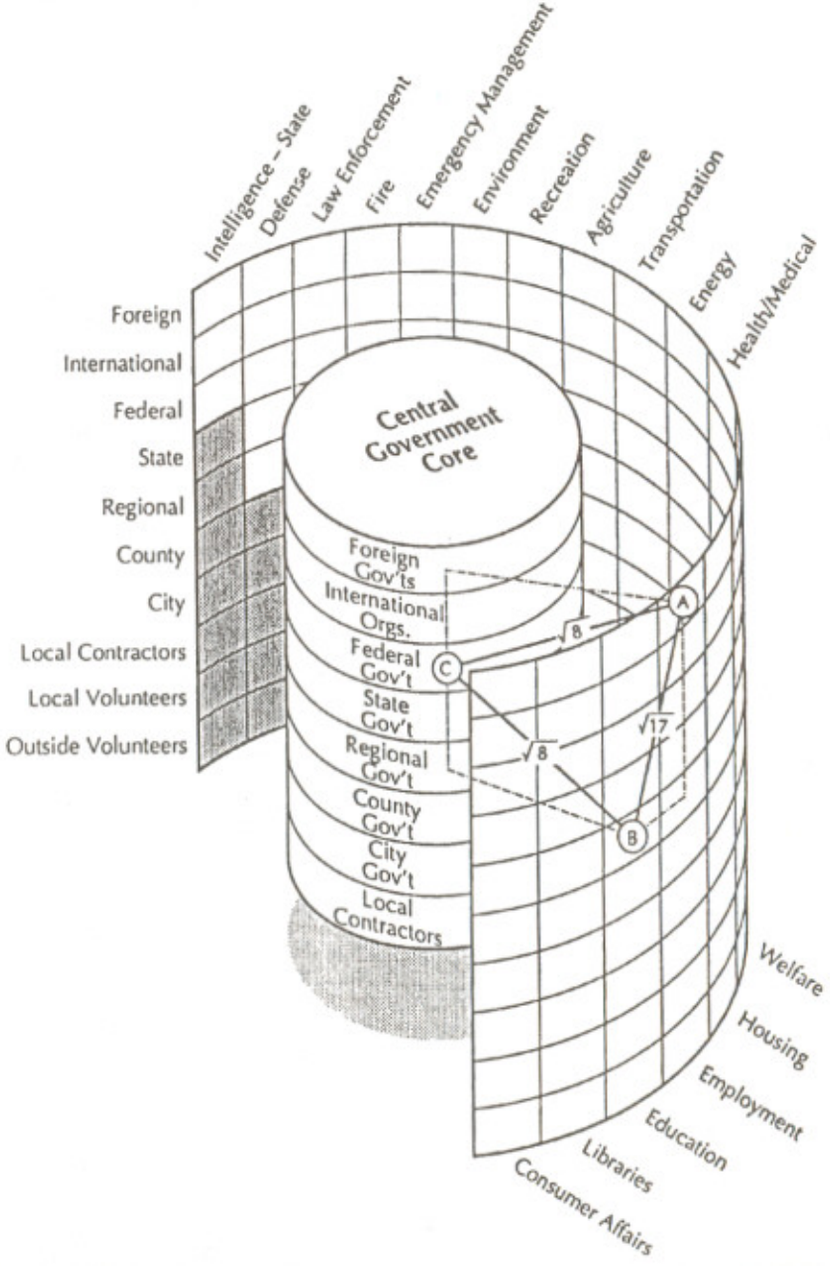


Exhibit 5
Hypothetical Disaster with Three Responses from Multiple Levels



Consider now a hypothetical local disaster in which the responders are 15 agencies drawn from the 15 boxes in Exhibit 3 at a single level, say the county level. Assume again that the intergovernmental distance from each functional box to the central core is 2 IDs and that the average distance between functional agencies within the county level is 7.5 IDs. (This is estimated by taking the closest possible distance, 1, adding it to the furthest possible distance, 14, and dividing by 2.) Then the total intergovernmental distance involved is the sum of the distances between each agency, plus the distance from each agency to the central core. Thus, the total intergovernmental distance is:

$$7.5[14+13+12...+1] + [2x15] + [0x0] = 871.5 \text{ IDs}$$

(The last term in the equation represent zero lines from the core to itself times zero distance for each line; this term will become important in the next calculation. Within each term the average distance of the line is multiplied times the number of lines.)

Now consider an enormous hypothetical disaster in which every one of the 157 boxes in the plane and all 8 central core levels responded with one organization. In this case the intergovernmental distance would be approximately 123,000:

$$10(156+155+154+153+...+1) + (5x157) + 4(7+6+5...+1) = 123,357$$

The point of all these calculations is the enormous increase in complexity between the last two examples. There is a 10-fold increase in the number of levels responding, but there is an increase of **150-fold** in the total intergovernmental distance involved (123,000 divided by 817.5). Thus complexity is increasing at more than the **square** of the number of new levels (150 is more than 10x10). This illustrates two points: disaster communications among different levels of government and organization are inherently complex and difficult, and, the addition of multiple levels and functional areas to the response results in an exponential increase in the level of complexity and difficulty.

A Multifactor Approach

The model presented above included numerous assumptions, not least of which was the assumption that all factors other than the actual distance in the model were held constant. In essence, the model argues that $y = f(x)$, where x is the distance calculated from the model and y is predicted disaster communications difficulties. Relaxing this assumption leads to a multifactor, regression equation approach with the familiar form:

$$y = a + b1X_1 + b2X_2 + ...b_nX_n + e,$$

in which y is predicted disaster communications difficulties, X_1 is distance estimated from the model and the other independent variables are all the other factors that might affect intergovernmental distance. Some of these might include extent of previous professional and social contact, extent of common training and exercises undertaken, existence of common terminology, acceptance of a specified chain of command, common definition of roles and responsibilities, common understanding of procedures, and many other factors (some of which were listed in the "definition" section above.) Whether these independent variables and the complicated dependent variable can be measured, we leave to future research; our purpose is only to lay out a conceptual approach. Clearly a multiple factor model more closely approximates reality. It also can identify factors that need to be taken into account in efforts to reduce communication complexity and high intergovernmental distance present in large intergovernmental disaster responses. However, the three dimensional model presented in Exhibits 3, 4, and 5 has the advantage of simplicity and clarity, and is useful as a heuristic device.

Assumptions Underlying the Model

Most of the model's assumptions have already been discussed. Three others need to be identified. First, the model as presented in Exhibits 3,4, and 5 assumes that the functional areas are arranged in a plane, when it may be closer to reality to think of complex bundles or clusters lying on a plane. For example, one could imagine a bundle at the local

level consisting of the police, fire and emergency management functions, with little distance between these three functions, and a separate bundle of health, welfare, housing and education functions.

Second, the model assumes that these 10 levels of government and organization and these 17 functional areas are the correct ones; this is in fact a matter for debate and empirical research.

Third, the model assumes that each box has only one organization in it and that this organization responds monolithically. In fact, we know that each box can have several organizations, and that each organization can have tremendous complexity within it. In effect this means that each box in the plane in Exhibit 3 actually has a three dimensional cube projecting out from the back of the box. Like any model, this exhibit is an abstraction from, and simplification of, the complexity of reality.

Policy Implications of the Theory

The theory of intergovernmental distance seems to correspond well with the general and case study-based observations of actual disasters made by academic, journalistic and practitioner researchers. (See, for example, Drabek et al., 1981; Dillman et al., 1982; OMNCS, 1983; Perry et al., 1980; Quarantelli, 1983; Scanlon and Prawzick, 1986; and Stephens, 1980.) This expanded theory of disaster communication has some explanatory power and approximates reality, but what are its policy implications?

First, the theory sheds some light on why intergovernmental response to disasters is so problematic. Inherent differences among organizations, compounded by the nature of federalism, work to impede effective coordination and cooperation. When many agencies respond to a disaster, tremendous effort must be exerted to overcome these differences (i.e., reduce their intergovernmental distance) in order to implement an effective response. The theory shows that the problem is not occasional, anecdotal or unique to particular disasters, but is endemic to all the intergovernmental disaster responses.

Second, the theory implies that difficulties in intergovernmental and interagency communications will increase dramatically--probably exponentially--in response to increases in the size of the disaster and the number of responding agencies. A team led by Drabek (1981)

demonstrated the complexity of communications in fairly simple disasters. The theory of intergovernmental distance points to the complexity and difficulty--and yet the necessity--of planning for "the big one."

Third, this theory has the potential for use in predicting, and thereby mitigating, problems in disaster communications. Disaster prone areas could perhaps hypothesize which organizations might respond in various disaster scenarios, roughly estimate the pre-disaster intergovernmental distance involved, and get a picture of the potential difficulties that might arise. Large intergovernmental distances would indicate the need to initiate some sort of mitigating activity. By fully defining the variables which affect the intergovernmental distance, one could identify specific areas in which to focus mitigation efforts. The multifactor version of the theory could also perhaps be used to help evaluate mitigation efforts, by allowing pre- and post-measurements of mitigation programs and identification of the contribution of various different programs.

Finally, and perhaps most significantly, the theory provides a framework through which disaster response coordinators can decide which organizations should participate in emergency planning and in emergency response. The theory shows that each organization added, brings with it costs in terms of communications and coordination difficulties. The marginal benefits of adding each such organization to the disaster response must outweigh the marginal costs if the disaster response is to be managed effectively. Organization benefits could include essential skills, added people-power, equipment, local knowledge, funds, and other resources. Yet, these organizational contributions are not costless to the disaster response because, as the theory shows, each organization adds also geometrically to the magnitude of communications problems. This study confirms the maxim, "more is not necessarily better."

NOTES

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